

FORM PTO-1390  
(Rev. 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER  
PATRADETRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/889361

INTERNATIONAL APPLICATION NO.  
PCT/DK00/00013INTERNATIONAL FILING DATE  
14 January 2000PRIORITY DATE CLAIMED  
15 January 1999

## TITLE OF INVENTION

Process and Apparatus for Cleaning of Waste Water

## APPLICANT(S) FOR DO/EO/US

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1.  This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2.  This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3.  This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4.  The US has been elected by the expiration of 19 months from the priority date (Article 31).
5.  A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a.  is attached hereto (required only if not communicated by the International Bureau).
  - b.  has been communicated by the International Bureau.
  - c.  is not required, as the application was filed in the United States Receiving Office (RO/US).
6.  An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))
  - a.  is attached hereto.
  - b.  has been previously submitted under 35 U.S.C. 154(d)(4).
7.  Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a.  are attached hereto (required only if not communicated by the International Bureau).
  - b.  have been communicated by the International Bureau.
  - c.  have not been made; however, the time limit for making such amendments has NOT expired.
  - d.  have not been made and will not be made.
8.  An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.  An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10.  An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11 to 20 below concern document(s) or information included:**

11.  An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12.  An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.  A **FIRST** preliminary amendment.
14.  A **SECOND** or **SUBSEQUENT** preliminary amendment.
15.  A substitute specification.
16.  A change of power of attorney and/or address letter.
17.  A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18.  A second copy of the published international application under 35 U.S.C. 154(d)(4).
19.  A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20.  Other items or information:

21.  The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):**

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1000.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$860.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$690.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00

**ENTER APPROPRIATE BASIC FEE AMOUNT =****CALCULATIONS PTO USE ONLY**

Surcharge of \$130.00 for furnishing the oath or declaration later than  20  30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$ 1,000.00

\$ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$
Total claims	- 20 =		x \$18.00	\$
Independent claims	- 3 =		x \$80.00	\$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	\$
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$ 1,130.00
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+ \$ 565.00	
<b>SUBTOTAL =</b>				\$ 565.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).			\$	
<b>TOTAL NATIONAL FEE =</b>				\$ 565.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +			\$	
<b>TOTAL FEES ENCLOSED =</b>				\$ 565.00
				<b>Amount to be refunded:</b> \$
				<b>charged:</b> \$

- a.  A check in the amount of \$ 565.00 to cover the above fees is enclosed.
- b.  Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c.  The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-3704. A duplicate copy of this sheet is enclosed.
- d.  Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

James C. Wray  
1493 Chain Bridge Road, Suite 300  
McLean, VA 22101

  
SIGNATUREJames C. Wray  
NAME

16 July 2001

REGISTRATION NUMBER

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**STATEMENT UNDER 37 CFR 3.73(b)**Applicant/Patent Owner: Jan OlsenApplication No./Patent No.: 09/889,361Filed/Issue Date: 07/16/2001Entitled: Process and Apparatus for Cleaning of Waste WaterFunki Manura A/S, a Danish corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

- the assignee of the entire right, title, and interest; or
- an assignee of less than the entire right, title and interest.  
The extent (by, percentage) of its ownership interest is \_\_\_\_\_ %

in the patent application/patent identified above by virtue of either:

A.  An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

OR

B.  A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

1. From: \_\_\_\_\_ To: \_\_\_\_\_  
The document was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.
2. From: \_\_\_\_\_ To: \_\_\_\_\_  
The document was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.
3. From: \_\_\_\_\_ To: \_\_\_\_\_  
The document was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

 Additional documents in the chain of title are listed on a supplemental sheet. Copies of assignments or other documents in the chain of title are attached.

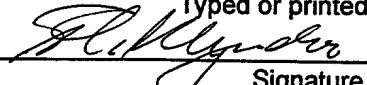
[NOTE: A separate copy (i.e., the original assignment document or a true copy of the original document) must be submitted to Assignment Division in accordance with 37 CFR Part 3, if the assignment is to be recorded in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

198 - 2001  
Date

Funki Manura A/S

Typed or printed name



Signature

director

Title

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Jan OLSEN

Serial No.: To be assigned

Filed: Concurrently herewith

For: PROCESS AND APPARATUS FOR CLEANING OF WASTE WATER

**PRELIMINARY AMENDMENT**

To the Director of Patents and Trademarks

Sir:

Before considering this application, kindly amend the application as follows:

In the Abstract:

Kindly enter and approve the abstract attached hereto.

In the Specification:

Page 1, before line 3, insert:

**--BACKGROUND OF THE INVENTION--;**

before line 31, insert:

**--SUMMARY OF THE INVENTION--.**

Page 5, before line 13, insert:

**--BRIEF DESCRIPTION OF THE DRAWINGS--;**

before line 30, insert:

**--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--**

In the Claims:

Kindly amend claims 1, 3, 4, 5, 6, 7 and 8 as follows:

1. (Amended) Process for cleaning of biological waste water which contains more mobile compounds and less mobile compounds compared to the mobility of water, said compounds being present as weak acids and weak bases, by evaporation of the waste water, by heating the waste water in a boiler, where the generated steam is cleaned for unwanted gaseous compounds, where the steam is taken from the boiling step via a compression step to a heat exchanging step, where the water is condensed, characterized in that the steam from the boiler is conducted to a column, in which the steam is flowing countercurrently to a fraction of the condensed water in order in a liquid form to remove the less mobile compounds including a part of the more mobile compounds and the less mobile compounds which are taking in the acid/base reactions, in that the steam fraction containing a remaining part of the more mobile compounds are led from the column via the compression step to the heat exchanging step, where the main part of the more mobile compounds are concentrated and drained off together with a remaining fraction of the steam, and in that the condensed and cleaned waste water is drained off to recipient.

3. (Amended) Process according to claim 1, characterized in that the steam which has left the column is condensed in a heat exchanger with its own condensate as countercurrent flow.

4. (Amended) Process according to claim 1, characterized in that acid/base reactions in the column are taking place upon the surface of the column elements.

5. (Amended) Process according to claim 1, characterized in that the remaining fraction of the condensed water which is led to the column constitutes 5-25% of the total condensate.

6. (Amended) Process according to claim 1, characterized in that the compounds which in liquid form are led from the column and back to the boiler are emptied herefrom when the concentration has achieved a predetermined level.

7. (Amended) Process according to claim 1, characterized in that the heat exchanging step is carried out in a downdraught evaporation heat exchanger, where the gas fraction flows countercurrently with its own condensate.

8. (Amended) Apparatus suitable for use in the process according to claim 1 and which comprises a boiler, a column, a compressor, and a heat exchanger, where the compressor is placed between the column and heat exchanger, and where a pump is placed between the boiler and heat exchanger for transference of the content of the boiler to the heat exchanger for heat exchanging of the steam from the column and characterized in that the column is connected with a steam tapping from the boiler.

REMARKS UNDER 37 C.F.R. 1.111

Reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

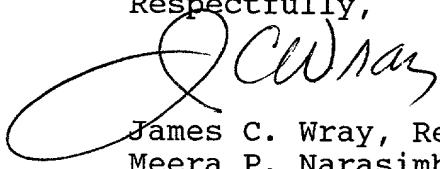
Reconsideration and allowance are respectfully requested.

Entry of the amendment and consideration and allowance of all claims are respectfully requested.

Applicant has also provided an abstract in compliance with the rules.

Since Applicant has presented a novel, unique and non-obvious invention, reconsideration and allowance are respectfully requested.

Respectfully,



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July 16, 2001

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claims 1, 3, 4, 5, 6, 7 and 8 have been amended as below:

1. (Amended) Process for cleaning of biological waste water which contains more mobile compounds and less [more] mobile compounds compared to the mobility of water, said compounds being present as weak acids and weak bases, by evaporation of the waste water, by heating the waste water in a boiler, where the generated steam is cleaned for unwanted gaseous compounds, where the steam is taken from the boiling step via a compression step to a heat exchanging step, where the water is condensed, characterized in that the steam from the boiler is conducted to a column, in which the steam is flowing countercurrently to a fraction of the condensed water in order [to] in a liquid form to remove the less mobile compounds including a part of the more mobile compounds and the less mobile compounds which are [taken] taking in the acid/base reactions, in that the steam fraction containing a remaining part of the more mobile compounds are led from the column via the compression step to the heat exchanging step, where the main part of the more mobile compounds are concentrated and drained off together with a remaining fraction of the steam, and in that the condensed and cleaned waste water is drained off to recipient.

3. (Amended) Process according to claim 1 [or 2], characterized in that the steam which has left the column is

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condensed in a heat exchanger with its own condensate as countercurrent flow.

4. (Amended) Process according to [any of the preceding claims] claim 1, characterized in that acid/base reactions in the column are taking place upon the surface of the column elements.

5. (Amended) Process according to [any of the preceding claims] claim 1, characterized in that the remaining fraction of the condensed water which is led to the column constitutes 5-25% of the total condensate.

6. (Amended) Process according to [any of the preceding claims] claim 1, characterized in that the compounds which in liquid form are led from the column and back to the boiler are emptied herefrom when the concentration has achieved a predetermined level.

7. (Amended) Process according to [any of the preceding claims] claim 1, characterized in that the heat exchanging step is carried out in a downdraught evaporation heat exchanger, where the gas fraction flows countercurrently with its own condensate.

8. (Amended) Apparatus suitable for use in the process according to [any of the preceding claims] claim 1 and which comprises a boiler, a column, a compressor, and a heat exchanger, where the compressor is placed between the column and heat exchanger, and where a pump is placed between the boiler and heat exchanger for [tranference] transference of the content of the boiler to the heat exchanger for heat exchanging of the steam

from the column and characterized in that the column is connected with a steam tapping from the boiler.

#### ABSTRACT OF THE DISCLOSURE

A process for cleaning of waste water and a corresponding apparatus for the embodiment hereof is described. By the process a column step is combined with a heat exchanging step, where the vapors from the waste water are led to the column, where the compounds in the waste water, which comprise more and less mobile compounds in relation to the mobility of the water, including inter alia weak acids and weak bases, will react and can be removed. By cleaning of manure an essential reaction between acetic acid and ammonia will occur. Additional compounds, including the more mobile compounds, inter alia ammonia, are conducted as steam via a compression step further on to the heat exchanger, where they condense and flow countercurrently to its own condensate. From the heat exchange the more mobile content compounds can hereafter as steam be removed for possible further heat exchanging. The well cleaned waste water can at the bottom be drained off as condensate. By heat exchanging of manure an essential part of the more mobile compounds will consist of ammonia, which drained off at the top of the heat exchanger.

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Process and apparatus for cleaning of waste water.

The present invention relates to a process for improving plants for waste water cleaning, in which evaporation by means of steam compression as a cleaning method is a  
5 part.

Waste water cleaning plants, which use evaporation by means of steam compression, are typically minor plants for cleaning of a special kind of waste water such as e.g. heavy metal containing waste water, used cooling lubricants, water-based degrease  
10 liquids and waste water from various washing processes. The cleaned water has hitherto typically been reused or drained off for canalization. Types of waste water containing big amounts of compounds, which are mobile at the temperature and the pH at which the evaporation is taking place, are normally not suited for a cleaning-up process in a waste water cleaning plant, which uses evaporation by means of steam compression,  
15 because the cleaned water as a rule will be too unclean for re-use, and furthermore a draining off for canalization will be very problematic, because of a too big remaining content of mobile compound.

The process described in this invention makes waste water cleaning plants with evaporation by means of steam compression especially suited for cleaning of biological  
20 waste water containing mobile compounds in form of weak acids and weak bases.

As an example of a such kind of waste water, which often contains big amounts of mobile compounds, is waste water, which is produced in connection with one or more  
25 biological processes, such as e.g. manure from pigs, manure from cattles, toilet water, waste water from production of medicin, washing water from slaughteries and cooling lubricants, including said kinds of waste water, which have putrefied. A big part of the mobile compounds, which normally evolve by biological decomposition processes will be present as weak acid/base couples.

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The present invention relates to a process for cleaning of biological waste water, which contains more mobile compounds and less mobile compounds in relation to the

mobility of water, and which are present as weak acids and weak basis. The process uses inter alia an evaporation of the waste water, where the waste water is heated in a boiler. The formed steam is cleaned by this approach for unwanted gaseous compounds, and it is transferred from this boiling step via a compression step to a heat exchanging step, where the water is condensed and drained off in cleaned form to the recipient, and where the bigger part of the more mobile compounds is concentrated and drained off together with the remaining fraction of steam.

It appears that the described new process is advantageous in relation to prior art inter alia by the fact that the steam from the boiler is being led to a column, where the steam is transferred in counterflow with a fraction of the condensed water. By this method the less mobile compounds are removed in a liquid form. Furthermore a part of the more mobile compounds and the less mobile compounds becomes a part of the related aqueous acid/base reactions.

Thus it appears that the less mobile compounds and a remaining part of the more mobile compounds are present in the steam from the heating of the waste water. These compounds are as mentioned led further from the column via the compression step to the heat exchanging step, where a concentration is taking place and draining off of the bigger part of the more mobile compounds together with a remaining fraction of steam, and where eventually condensed and cleaned waste water is led out to the recipient.

The invention encompasses furthermore an apparatus for the embodiment of the process.

By evaporation of the biological waste water, which contains more mobile compounds and less mobile compounds relative to the mobility of the aqueous solvent it is desirable that the amount of the more mobile compounds is as little as possible, because a presence hereof will require an increased supply of heat for a sufficient evaporation. The reason for this is that these more mobile compounds consist of compounds which are not condensable by the magnitudes of pressure and temperature which are applied

by the evaporation of the basic liquid of the solution, which normally is water, and therefore they will be inhibitory for the evaporation of water, because they are present as an insulating layer within the heat exchanger. Because such a layer will act as an inhibitor for the heat transmission to the condensable compounds within the heat exchanger it will implicate an increase of the energy consumption.

By evaporation of liquid biological waste the more mobile dissolved compounds present will inter alia be carbon dioxide and ammonia and the less mobile dissolved compounds will inter alia be fatty acids, mineral acids and their salts. Included are said compounds in both neutral and charged form.

Apart from the described increase of the sufficient heat transmission as a consequence of a presence of the more mobile compounds during the evaporation another kind of disadvantages will be present at the evaporation of such liquid according to prior art and this involves inter alia the energy consumption in the subsequent compression step. A content of not condensable compounds, as for instance carbon dioxide, will firstly occupy space within that water steam which is withdrawn from the boiler to the heat exchanger, and this implies a loss of efficiency. Secondly, the presence of the more mobile compounds in the water steam from the column will cause to an increase of the energy consumption in the subsequent compression step.

Another main compound, which belongs to the group of the more compounds, is frequently as mentioned above ammonia, which it is likewise desirable to remove, before the vapours are led into the heat exchanger. An applicable method for this is to conduct the ammonia vapours through a scrubber, as it is described in patent DK 171611. This has proven to be efficient, but does, however, involve disadvantages, as supply of various chemicals are needed, which is in detail described in patent DK 171611. Such a further proces step is both laborious and costly.

As mentioned compounds are present in the said liquid, which compounds are less mobile than the liquid in which they are dissolved, and the present invention comprises furthermore a removal of these compounds. A method for this is described in

patent application DK 01288/96, according to which a concentration of the compounds firstly takes place in the boiler used for the above described evaporation. The heated liquid is being led to a column, from which the more mobile compounds in gaseous form are led to the primary side of a first heat exchanger, so that these more 5 mobile compounds are condensed and led out from the primary side, and from the same column the less mobile compounds are led in liquid form to the secondary side of the above mentioned first heat exchanger, where they are heat exchanged with the condensed more mobile compounds. By this approach additional parts of the more mobile compounds in the secondary side of the heat exchanger are evaporated and led 10 to said column, from which they, in gaseous form, are led to the primary side of said first heat exchanger, and the heated liquid is led following a total or partly separation of the more mobile compounds back to the boiler. By more cycles of the column and the heat exchanger additional parts of the more mobile compounds are evaporated and carried to the column, from which they are circulated to the primary side, where they 15 are condensed.

The present method is remarkable by a decreased energy consumption in relation to known methods and a consumption of chemicals which is totally eliminated. The invention will as an example in the following be described in more detail based on 20 cleaning of manure, the method, however, is not to be limited to this. Examples of other liquids, which can be cleaned by an approach according to the present invention are - apart from the above mentioned biological waste liquids in general, which as already known inter alia comprise manure - emulgated liquids, as e.g. cooling/oil lubricants oil emulsions, degreasing liquids, oil containing waste water, waste water 25 from laundries, solvents and waste water from food production and its like.

Based upon an example of manure as the liquid to be cleaned, the unwanted compound will comprise CO<sub>2</sub>, NH<sub>3</sub>, NH<sub>4</sub><sup>+</sup>, fatty acids, including CH<sub>3</sub>COOH, and other organic liquids. The unwanted compounds can be present in neutral and/or charged 30 form and/or as salts.

A method and an apparatus of the known type can as an example be formed according to the disclosure in patent DK 171611. Here manure is de-gassed and during subsequent passage through a scrubber the present ammonia and acetic acid are neutralized by addition of calculated amount of acid and base.

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In order to disclose the present invention in more details the technological background for this will be the until now known technology with reference to patent application DK 0868/94, patent DK 171611, and patent application DK 01288/96. The disclosure will be based on the below described figures 1-6, to which reference is made to an outline of the explanations for the used designations, which is placed at the end of the description.

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Fig. 1 shows a plant for waste water cleaning with known technology by means of the scrubber 52 (comprising scrubber 53 and scrubber 54),

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Fig. 2 shows a diagramme of an embodiment of a scrubber with known technology,

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Fig. 3 shows a diagramme of an embodiment of the technology in a plant, which uses the present invention with column and heat exchanger,

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Fig. 4 shows especially that part of the plant with combination of a column and a heat exchanger in Fig. 3, which the present invention makes use of,

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Fig. 5 shows in- and outlets from a column in an embodiment according to the present invention and the relevant chemical equilibriums, and

Fig. 6 shows a diagramme of an embodiment of a heat exchanger with its in- and outlets according to the present invention.

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In the description the known technique will be described based upon Fig. 1 with reference to Fig. 2, which especially discloses the function of the scrubber. By explanation of the approach in the present invention focus will be upon Fig. 3 with Fig. 1 as refer-

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ence. Figs. 4-6 serve especially the purpose of showing those processes which in combination replace and improve the until now known scrubbing, which is included in Fig. 1.

5 Fig. 1 shows a schematic illustration of an example of an embodiment for a plant according to known technology from Danish patent application DK 01288/96. The plant comprises a column 1, a first heat exchanger 2, a compressor 3, a bottom vessel 4 for the column 1, a circulation pump 5 receiving liquid from outlet 36, a motor valve 6, a contravalue 7, a gas/liquid separator 8, a level sensor 9 for control of liquid level in the  
10 bottom vessel 4 for column 1, a first section 10 of a second heat exchanger, a second section 11 of the second heat exchanger, a third heat exchanger 12, a first motor valve 13, and a second motor valve 14. The column 1 is provided with nozzles 15 for draining off of liquid biological waste in column 1.

15 The column 1 is provided with an inlet 16 for the liquid biological waste to the column 1. As a non-limiting example of liquid biological waste will as mentioned manure be applied in the following part of the description. The manure is led to the column 1 in order to be separated in column 1 into more mobile compounds and less mobile compounds. The more mobile compounds are led to a foam restrictor 17 in an  
20 upper part of the column 1. The less mobile compounds are led to the bottom vessel 4 in the bottom of column 1. When the liquid biological waste is manure the more mobile compounds will inter alia comprise carbon dioxide ( $\text{CO}_2$ ) and ammonia ( $\text{NH}_3$ ), and the less mobile compounds will inter alia comprise water ( $\text{H}_2\text{O}$ ), fatty acids and mineral salts.

25 Before the manure is led to column 1 the manure is heated, because it is led through a secondary side of the first section 10 and a secondary side of the second section 11 of the second heat exchanger. The first section 10 of the second heat exchanger is provided with an inlet 18 for the manure. The inlet 18 is provided with a motor valve 14 for inlet of the manure to the first section 10. The first section 10 is provided with an outlet 19, which leads to an inlet 20 for the second section 11 of the second heat exchanger. The second section 11 is provided with an outlet 21, which leads to the inlet

16 to the column 1. The manure is supposed to achieve a rise of temperature to the boiling point of the manure, before the manure is led to the nozzles 15 in column 1.

Following the transference of the manure through the nozzles 15 in column 1 and as  
5 mentioned separated into more mobile compounds and less mobile compounds the  
more mobile compounds are led from an outlet 22 from the foam restrictor 17 to the  
compressor 3, where the more mobile compounds are compressed. After the more  
mobile compounds are compressed the more mobile compounds are led to an inlet 23  
10 of a primary side of the first heat exchanger 2. The more mobile compounds are led  
through the primary side of the first heat exchanger 2 to an outlet 24 from the primary  
side of the first heat exchanger 2. The more mobile compounds are thereafter led to an  
inlet 25 of a primary side of the second section 11 of the second heat exchanger. The  
more mobile compounds are led through the primary side of the second section 11  
and to an outlet 26 of the second section 11 of a second heat exchanger.

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After being led through the primary side of the first heat exchanger 2, respectively the  
second section 11 of the second heat exchanger the more mobile compounds are partly  
condensed and consist of a gas fraction and a liquid fraction. From the outlet 26 of the  
primary side of the second section of the second heat exchanger the gas fraction and  
20 the liquid fraction of the more mobile compounds are led to an inlet 27 to the  
gas/liquid separator 8.

The liquid fraction from an outlet 28 of the separator 8 is led to an inlet 29 of the liq-  
uid fraction and to nozzles 30 in column 1 as reflux. The gas fraction from the separa-  
25 tor 8 with the more mobile compounds are from an outlet 31 led to an inlet 32 to a  
primary side of the third heat exchanger 12. In the third heat exchanger 12 a total con-  
densing of the gas fraction is taking place. By condensing of the gas fraction the car-  
bon dioxide ( $\text{CO}_2$ ) diffuses into the liquid, where it together with water ( $\text{H}_2\text{O}$ ) and  
ammonia ( $\text{NH}_3$ ) form ammonia hydrogen carbonate ( $\text{NH}_4\text{HCO}_3$ ). This ammonia hy-  
30 drogen carbonate is led to an outlet 33 from the primary side of the third heat ex-  
changer and it can be stored in a normal closed container (not shown) and can be  
drained off from here.

Those parts of the manure, which are led to the second heat exchanger, are as a start led to a secondary side of the third heat exchanger 12. The manure is led to an inlet 34 to the secondary side of the third heat exchanger 12 by means of the first motor valve 13 and through the secondary side of the third heat exchanger 12 to an outlet 35 from the secondary side. From the outlet 35 of the secondary side of the third heat exchanger 12 the manure is led through the inlet 20 of the secondary side of the second section 11 of the second heat exchanger.

10 The less mobile compounds are as mentioned led to the bottom vessel 4 of the column 1. From an outlet 36 from the bottom vessel 4 the less mobile compounds in liquid form are by means of a circulation pump 5 (receiving liquid from outlet 36) led to an inlet 37 for a secondary side of the first heat exchanger 2. The level sensor 9 in the bottom vessel 4 of the column 1 assures that the less mobile compounds are not led from the bottom vessel 4, before a sufficient amount of the less mobile compounds are present in the bottom vessel 4 of the column 4. The less mobile compounds are led through the secondary side of the first heat exchanger 2 for evaporation of possible additional more mobile compounds and back to the bottom vessel 4 of the column 1. Intermittently parts of the liquid containing the less mobile compounds are drained off during the circulation of the less mobile compounds from the bottom vessel 4 for the column 1 and through the secondary side of the first heat exchanger 2. The draining off from the secondary side of first heat exchanger 2 is taking place through outlet 38, through the contra valve 7 and the motor valve 6. The part of the liquid containing the less mobile compounds can be described as de-gassed, this is to say free of the more mobile compounds, and it can be led further on to a possible additional treatment such as an evaporation.

The more mobile compounds will by compression in the compressor 3 achieve a temperature which is higher than the temperature of the manure being led to the nozzles 30 15 of the column 1.

The less mobile compounds are led following passage of the motor valve 6 to a vessel 41 for the processing, which is connected with the scrubber 52 (comprising scrubber 53 and scrubber 54), and the functional correlation can be formed as described in patent application DK 0868/94, and reference is made to the following Fig. 2. According  
5 to the known technique the polluted liquid is heated in the vessel 41 for the processing linked to the scrubber 52 (comprising the scrubber 53 and the scrubber 54), whereafter a circulation pump 43 (connected with outlet from the processing vessel) is conducting the liquid to the top of the evaporator. At the bottom an outlet is provided, which can drain off the concentrated and polluted part of from the processing vessel 41, which is  
10 linked to the scrubber 52 (comprising the scrubber 53 and the scrubber 54). At the top of this a steam tapping 47 is provided, which is linked to a compressor 49, which furthermore via said scrubber 52 is connected with a downdraught evaporation heat exchanger 50, which is placed above the container for the processing vessel 41 (linked to the scrubber 52) within the evaporator. In the bottom of said heat exchanger 50 an  
15 outlet pipe 51 is placed for the clean condensate.

Fig. 2 shows a plant of known type from Danish patent application DK 0868/94 comprising inter alia an evaporator 39 and the scrubber 52. At the top of the evaporator a liquid distribution system 40 is provided, and at the bottom the vessel for the processing 41 is present (linked with the scrubber 52), which contains the concentrated processing liquid 42 (abbreviated C<sub>c</sub>). The vessel for the processing 41 is connected with a circulation pump 43 and a circulation pipe 44, which pumps the heated and polluted processing liquid 42 to the distribution system 40 at the top of the evaporator. The vessel 41 for the processing, which as mentioned is connected to the scrubber 52, has  
20 an inlet pipe 45 for supply of polluted processing liquid 42 and an outlet pipe 46, which is used for emptying of the concentrated and polluting concentrate (abbreviated C<sub>c</sub>) from the vessel 41 for the processing, which is connected to the scrubber 52 (comprising the scrubber 53 and the scrubber 54).  
25

At the top of the processing vessel 41 a steam tapping 47 is provided, which via a pipeline 48 and a compressor 49 is connected with a downdraught evaporation heat exchanger 50, which is placed inside the evaporator 39. At the bottom of the heat ex-

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changer 50 an outlet 51 is provided for clean condensate. The scrubber 52 (comprising the scrubber 53 and the scrubber 54) is placed in the steam pipe 48, in which also the compressor 49 is mounted. In the shown situation the scrubber 52 is placed upstream to the compressor 49. This is preferred, but it is also without difficulty possible to place the scrubber 52 downstream to the compressor 49.

It appears that the electrical managing of the plant is not shown in the drawing. However, such a managing system will be wellknown to a person skilled in the art and needs therefore no further explanation.

10

The polluted and concentrated process liquid 42 is transferred batchwise at the pipe 45 and drained off after an concentration has taken place via the outlet pipe 46. The clean condensate is drained off via the outlet pipe 51.

15

The scrubber 52 according to the known design comprises a first and a second scrubbing step 53, 54. The scrubber 53 contains an acid 55, and the scrubber 54 contains a base 56. Each of the scrubbers 53, 54 is provided with a pipe for acid 57 and a pipe for base 58. By this approach it is possible to exchange as a consequence of the measurements the liquid 55 and 56, so that the pH can be maintained constant during the evaporation.

20

The whole system is contained in a closed and insulated cabinet 59. An energy neutral process is thus achieved, because there is no needed exchange with the surroundings. This implies the advantage that condensation of the steam in an unwanted way is avoided at a step which has a lower temperature. If there were to be "cold steps" the process would stop, because the steam would condense in such a cold step instead of the wanted condensation in the downdraught evaporation heat exchanger 50.

25

When the polluted liquid is transferred into the processing vessel 41, which is connected to the scrubber 52, the shown level 60 for the processing liquid is achieved at a certain point of time, after which a float switch for regulation of the inlet of the polluted liquid 61 is activated, whereby a heating element (not shown) and a circulation

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pump 43 are switched on. The temperature is hereby increased to a temperature and pressure, which is closely below the boiling point of the liquid, which is to be cleaned (the condensate). If the liquid is water the temperature is increased to approximately 100°C.

5

The circulation pump 43 is started up in the plant to ensure that all components have the same temperature. When the temperature has achieved about 100°C the compressor 49 is started. The compressor 49 creates a vacuum in the processing vessel 41 linked to the scrubber 52 and thereby forces the steam placed over the polluted and concentrated processing liquid 42 through the scrubber 42, after which the steam via the pipeline 48 is transferred to the heat exchanger 50, where heat exchange is taking place of the steam at the one side of the heat exchanger and the heated, polluted and concentrated processing liquid 42 on the second side of the heat exchanger. By this the steam, which has been compressed in the compressor 49, will lose its energy, which is transferred to the circulated polluted liquid 42 on the second side of the heat exchanger. This has the consequence of an evaporation of the liquid which is to be cleaned. This steam penetrates along the one side down to the downdraught evaporation heat exchanger 50 and is streaming down into the top of the process vessel 41, which is connected to the scrubber 52, and will thus pass via the steam outlet 47 and through the scrubber 52, the pipeline 48 and the compressor 49 into the heat exchanger 50. The steam is condensed during energy loss and can then be drained off as cleaned condensate via the outlet pipe 51.

Within the pipe from the compressor 49 to the downdraught evaporation heat exchanger 50 a scrubber 52 has been placed, which as mentioned above is separated into two parts. The upper part 54 contains a base (NaOH) and the lower part 53 an acid ( $\text{HNO}_3$ ), which are supplied through a pipe for each liquid. This permits a regulation of the added amounts of acid and base, respectively, as a consequence of the results of the current measurements, so that the pH can be maintained constant during the entire evaporation. The upstream part in the scrubber 52 (comprising the scrubber 53 and the scrubber 54) must always be supplied with acid in relation to the downstream alkaline part, because the acids are more mobile than the bases.

Both parts in the scrubber 52 are provided with devices for inhibition of bubbles, ripples and its like, which promotes splash and thereby risk of bringing droplets out into the steam pipe from the scrubber 52 to the heat exchanger 50.

5

The present approach, which is disclosed by this invention, is new and is remarkable in a surprising way which is advantageous in relation to the prior art and knowledge, including especially DK patent application 01288/96. The process according to the invention makes use of a mechanic and a process technical construction, which is more simple than the hitherto known technique within this field, which gives a lower level of expenditures. Apart from this the embodiment of this process renders advantages. It is thus a remarkable feature that the process is carried without supply and use of chemicals, which is a new and an obvious advantage with regard to the time period within which the process is taking place, as well as outside this time period. Concerning the time period in which the process is taking place, the hitherto known technology required thus a handling of the supply of the chemicals needed for the process. This handling is in all cases more or less laborious and therefore unwanted, which with the process according to the present invention can be avoided totally. Additionally, within that time period where the process is not working the needed chemicals to the process should - according to the hitherto known technique - be stored in a storage room, which of course is laborious and therefore desirable to avoid, and also the plant for both storage and handling should be approved by the authorities, which thus makes both the use and run of such a plant laborious. Those compounds, which are to be used here (see for instance DK patent application 01288/96), are favoured by a special attention by the authorities, because the use of the compounds are restricted environmentally, for what reason special measures are normally an inevitable requirement to an approval from the authorities. Finally it can be mentioned that the process according to the invention also has that economic advantage that the expenditures for purchase of chemicals are avoided, which makes the embodiment of the process cheaper in relation to the closest known technique.

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The disadvantages by the known technology, which is here shown by an example of a plant, is thus clearly that the operation is connected with the relatively high consumption of energy and a high use of chemicals.

5 The present invention will in the following be detailed with basis in Fig. 3, which shows an example of a flowsheet for a plant, which uses this invention.

The apparatus, which is shown in Fig. 3, consists of a downdraught evaporation heat exchanger 50, through which the liquid, that is under evaporation and is to be cleaned, 10 is circulated by means of the circulation pump 43, connected with the outlet from the processing vessel. The boiler liquid 42 is heat exchanging on its way down through the heat exchanger 50 with the condensing water steam from a absorption column 62, which constitutes an essential part of the present invention. Within the column 62 acid/base reactions are taking place as something very essential for the invention. Said 15 acid/base reactions are taking place between the present weak acids and weak bases, which as mentioned are more mobile compounds and less mobile compounds as judged relatively to the mobility of water. By the heat exchanging 50 the liquid is brought to the boiling point.

20 The downdraught evaporation heat exchanger 50 is placed above the boiler 42 in which a reservoir of liquid being under evaporation is present. The liquid is circulated by means of the pump 43. The pressure in the boiler 42 is kept constant during the evaporation by means of a pressor state 63 (for regulation of the heating element 64) which is activated when the pressure is below 5 mmbar overpressure compared to the 25 surroundings. The steam which arises by the boiling of the liquid in the heat exchanger 50 is streaming together with the liquid down into the boiler 42.

In the boiler 42 a liquid/steam separator 65 is placed which separates liquid and steam from each other, whereby the liquid is kept within the boiler 42, which the steam leaves through the separator 65. The steam flows from the liquid/steam separator 65 to the absorption column 62, in which the main part of impurities in the steam is removed. From the absorption column 62 the steam is flowing to the compressor 49,

which gives the steam an increase pressure, whereby the condensation temperature of the steam increases to such a degree that the steam is able to condense, when it flows over to the heat exchanger 50.

5      The condensate from the steam runs down to the bottom of the heat exchanger 50, in which it is collected until a certain level is achieved, which is determined by the float switch 66, which by activation opens valve 67 which permits the condensate to flow to the vessel 68. The level of liquid in boiler 42 is kept constant by means of valve 70, which opens by activation through the float switch 69 which permits that the liquid 10 which is to evaporate flows through said valve 70, a first heat exchanger 71 (in which the polluted liquid heat exchanges with the condensate), a second preheat exchanger 72 (in which the polluted liquid is heat exchanging with the steam) and is mixed with the liquid from the boiler 42, which is under evaporation and thereafter introduced into the downdraught evaporation heat exchanger 50.

15      In the condensate vessel 68 a reservoir of condensate is collected until the level which is determined by the level sensor 73 is achieved, which permits that the valve 74 opens and 75-95% of the condensate (abbreviated  $C_d$ ) leaves the apparatus through the first preheat exchanger 71, which is the heat exchanger which receives the incoming aqueous liquid W.

20      A part of the condensate (5%-25%) is pumped by means of pump 75 to the top of the absorption column 62, in which it is distributed to the column elements within the column. On its way down to the absorption column 62 the condensate absorbs the impurities from the steam, which rises up from the boiler 42 and acid/base reactions are taking place. In the legend to Fig. 4 these reactions are further explained.

25      The condensate containing the impurities is led from the bottom of the absorption column 62 to the process vessel 41, which is connected to the scrubber 52, in which it is mixed with the liquid which is under evaporation and cleaning. The part of the steam containing the more mobile compounds is led from the column 62 via the compressor 49 to the heat exchanger 50. The part hereof, which by passing through the heat ex-

changer 50, is not condensing, will in concentrated form together with the remaining amount of steam, flow over into the second preheat exchanger 72, in which it is cooled and condensed by heat exchanging with the incoming liquid W, to which is hereby added a further temperature rise. When the gas/liquid mixture temperature in the sec-  
5 ond heat exchanger 72 has fallen down to a certain level the termostate 76 is activated, whereby valve 77 opens, and the gas/liquid mixture flows to the vessel 78, in which the gas phase is separated from the liquid phase in the gas/liquid mixture in the second preheat exchanger 72.

10 The gas is drained off and in vessel 78 a reservoir of liquid is built up until a certain level determined by level sensor 79, after which valve 80 opens and the liquid flows to the process vessel 41, in which it is mixed with the liquid under evaporation and cleaning.

15 Fig. 4 shows that part of the plant in Fig. 3 that in concentrated form visualizes the invention, which thus combines an absorption column with a heat exchanger in which the condensate runs in counterstream with the steam which is to be condensed with an evaporation system.

20 Fig. 5 shows an example of an absorption column according to the invention, where a part of the condensate flows in countercurrent with the steam flowing from below. In the column the surface of the column elements is giving place for a number of acid/base reactions. Some relevant reactions in this connection are the equilibrium reaction (1)-(4)

25

- (1)  $\text{CH}_3\text{COOH} \text{ (gas)} \rightleftharpoons \text{CH}_3\text{COOH} \text{ (aq)},$
- (2)  $\text{CH}_3\text{COOH} \text{ (aq)} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+,$
- (3)  $\text{NH}_3 \text{ (gas)} \rightleftharpoons \text{NH}_3 \text{ (aq)},$
- (4)  $\text{NH}_3 \text{ (aq)} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-,$

30

which in addition are shown in the circle of the figure. In the left side of the circle are shown the compounds from the below coming steam and what is mentioned in the right side are relevant equilibria for what is flowing down to the bottom vessel.

5 Fig. 6 shows a heat exchanger according to the invention. On the figure is shown a downdraught evaporation heat exchanger, in which the condensing steam flows countercurrent to its own condensate.

10 The more mobile compounds in the steam, compared to the mobility of water, will be collected and drained off from the top of the heat exchanger. If the waste liquid which is to be cleaned is manure then a ammonia will be a big part of the above mentioned drained off material. At the bottom the condensate which is the cleaned liquid will be drained off.

15 Explanation for designations in Figs. 1-6:

- 1: column
- 2: first heat exchanger
- 3: compressor
- 20 4: bottom vessel for the column 1
- 5: circulation pump receiving liquid from outlet 36
- 6: motor valve
- 7: contra valve
- 8: gas/liquid separator
- 25 9: level sensor
- 10: first section of heat exchanger
- 11: second section of heat exchanger
- 12: third heat exchanger
- 13: first motor valve
- 30 14: second motor valve
- 15: nozzles for draining off of liquid biological waste from column 1
- 16: inlet for liquid biological waste to column 1

17: foam restrictor for upper part of column 1  
18: inlet for manure  
19: outlet from first section 10 of second heat exchanger  
20: inlet for second section 11 of second heat exchanger  
5 21: outlet from second section 11 of second heat exchanger  
22: outlet from foam inhibitor 17  
23: inlet for the primary side of the first heat exchanger 2  
24: outlet from the primary side of the first heat exchanger 2  
25: inlet from the primary side of the second section 11 of the second heat exchanger  
10 26: outlet from second section 11 of second heat exchanger  
27: inlet to gas/liquid separator 8  
28: outlet from separator 8  
29: inlet containing liquid for the nozzles 30  
30: nozzles 30 in column 1  
15 31: outlet containing gas fraction from the separator 8  
32: inlet containing the gas fraction to the primary side of the third heat exchanger  
33: outlet from primary side of the third heat exchanger  
34: inlet containing manure to the secondary side of the third heat exchanger 12  
35: outlet from the secondary side of the third heat exchanger 12  
20 36: outlet from the bottom vessel 4  
37: inlet from the secondary side of the first heat exchanger 2  
38: outlet from the secondary side of the first heat exchanger 2  
39: evaporator  
40: a liquid distribution system  
25 41: process vessel connected with scrubber 52  
42: concentrated process liquid (concentrate Cc) 42 or boiler p.14 l.8  
43: circulation pump connected with the outlet from the process vessel p.13 l.22,29  
44: circulation pipe  
45: inlet pipe  
30 46: outlet pipe with outlet of concentrate (Cc)  
47: steam tapping  
48: pipe for steam

49: compressor  
50: downdraught evaporation heat exchanger  
51: outlet pipe for clean condensate  
52: scrubber comprising scrubber 53 and 54  
5 53: scrubber containing acid  
54: scrubber containing base  
55: acid  
56: base  
57: pipe for acid  
10 58: pipe for base  
59: isolated cabinet  
60: level hight for process liquid  
61: level sensor for regulation of supply of polluted liquid  
62: absorption column  
15 63: pressostate for regulation of heating element 64  
64: heating element  
65: separator for separation of steam and liquid  
66: float switch, which by activation opens valve 67  
67: valve, which by opening permits condensate to flow to vessel 68  
20 68: vessel for condensate  
69: float switch, which by activation opens valve 70  
70: valve, which by opening permits the polluted liquid to pass through to a first pre-  
heat exchanger 71  
71: first preheat exchanger, through which the polluted liquid heat exchanges with  
25 condensate  
72: second heat exchanger, in which the polluted liquid heat exchanges with steam  
73: level sensor (in vessel 68), which by activation opens valve 74  
74: valve which by opening permits the condensate (Cd) to pass through the first pre-  
heat exchanger 71  
30 75: pump, which takes a part of the condensate to the top of 62  
76: termostate which by activation opens valve 77

77: valve which opening permits the gas/liquid mixture from 72 to pass further on to vessel 78

78: vessel, in which gas phase is separated from liquid phase in the gas/liquid mixture in 72

5      79: level sensor, which by activation opens valve 80

80: valve which by opening permits the liquid to flow further to the process vessel 41

C<sub>c</sub>: See 42 and 46 above

C<sub>d</sub>: See 74 above

10     W: Incoming polluted liquid, which is desired to be cleaned.

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**CLAIMS**

1. Process for cleaning of biological waste water which contains more mobile compounds and less <sup>nucleic</sup> ~~more~~ compounds compared to the mobility of water, said compounds being present as weak acids and weak bases, by evaporation of the waste water, by heating the waste water in a boiler, where the generated steam is cleaned for unwanted gaseous compounds, where the steam is taken from the boiling step via a compression step to a heat exchanging step, where the water is condensed, characterized in that the steam from the boiler is conducted to a column, in which the steam is flowing countercurrently to a fraction of the condensed water in order to in a liquid form to remove the less mobile compounds including a part of the more mobile compounds and the less mobile compounds which are <sup>taking</sup> part in the acid/base reactions, in that the steam fraction containing a remaining part of the more mobile compounds are led from the column via the compression step to the heat exchanging step, where the main part of the more mobile compounds are concentrated and drained off together with a remaining fraction of the steam, and in that the condensed and cleaned waste water is drained off to recipient.

2. Process according to claim 1, characterized in that the waste water is manure, which contains compounds, which comprise  $\text{CO}_2$ ,  $\text{NH}_3$ ,  $\text{NH}_4^+$ , fatty acids including  $\text{CH}_3\text{COOH}$ , where the less mobile compounds and the more mobile compounds are able to take part in acid/base reactions, and in that a part of the condensate from the heat exchanger is led countercurrently to the steam, which is conducted to the column from the boiler

3. Process according to claim 1 or 2, characterized in that the steam which has left the column is condensed in a heat exchanger with its own condensate as countercurrent flow.

4. Process according to any of the preceding claims, characterized in that acid/base reactions in the column are taking place upon the surface of the column elements.

5. Process according to any of the preceding claims, characterized in that the remaining fraction of the condensed water which is led to the column constitutes 5-25% of the total condensate.

6. Process according to any of the preceding claims, characterized in that the compounds which in liquid form are led from the column and back to the boiler are emptied herefrom when the concentration has achieved a predetermined level.

10

7. Process according to any of the preceding claims, characterized in that the heat exchanging step is carried out in a downdraught evaporation heat exchanger, where the gas fraction flows countercurrently with its own condensate.

15

16

8. Apparatus <sup>intake</sup> for use in the process according to any of the preceding claims and which comprises a boiler, a column, a compressor, and a heat exchanger, where the compressor is placed between the column and heat exchanger, and where a pump is placed between the boiler and heat exchanger for tranference of the content of the boiler to the heat exchanger for heat exchanging of the steam from the column and characterized in that the column is connected with a steam tapping from the boiler.

20

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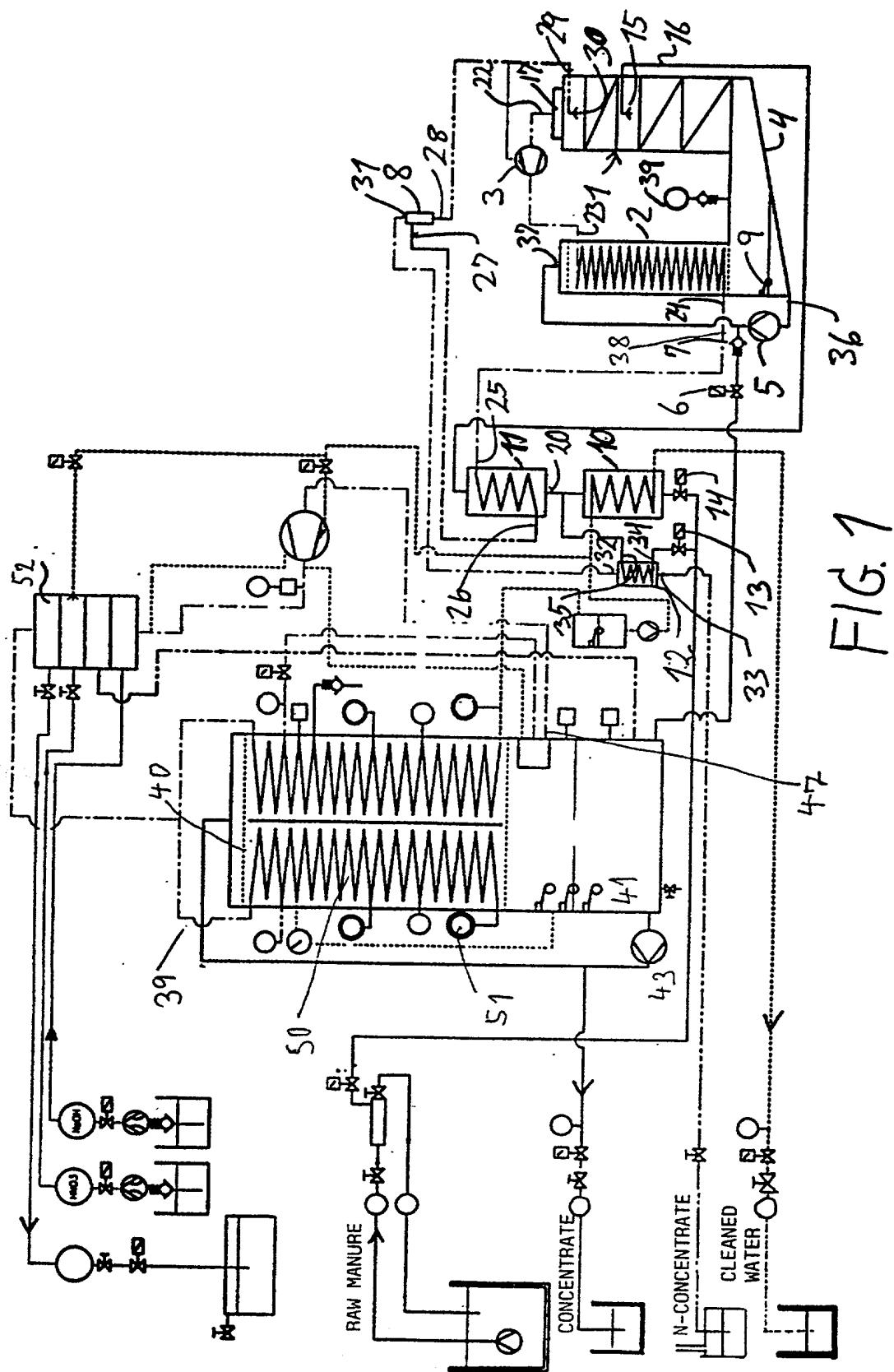


FIG. 1

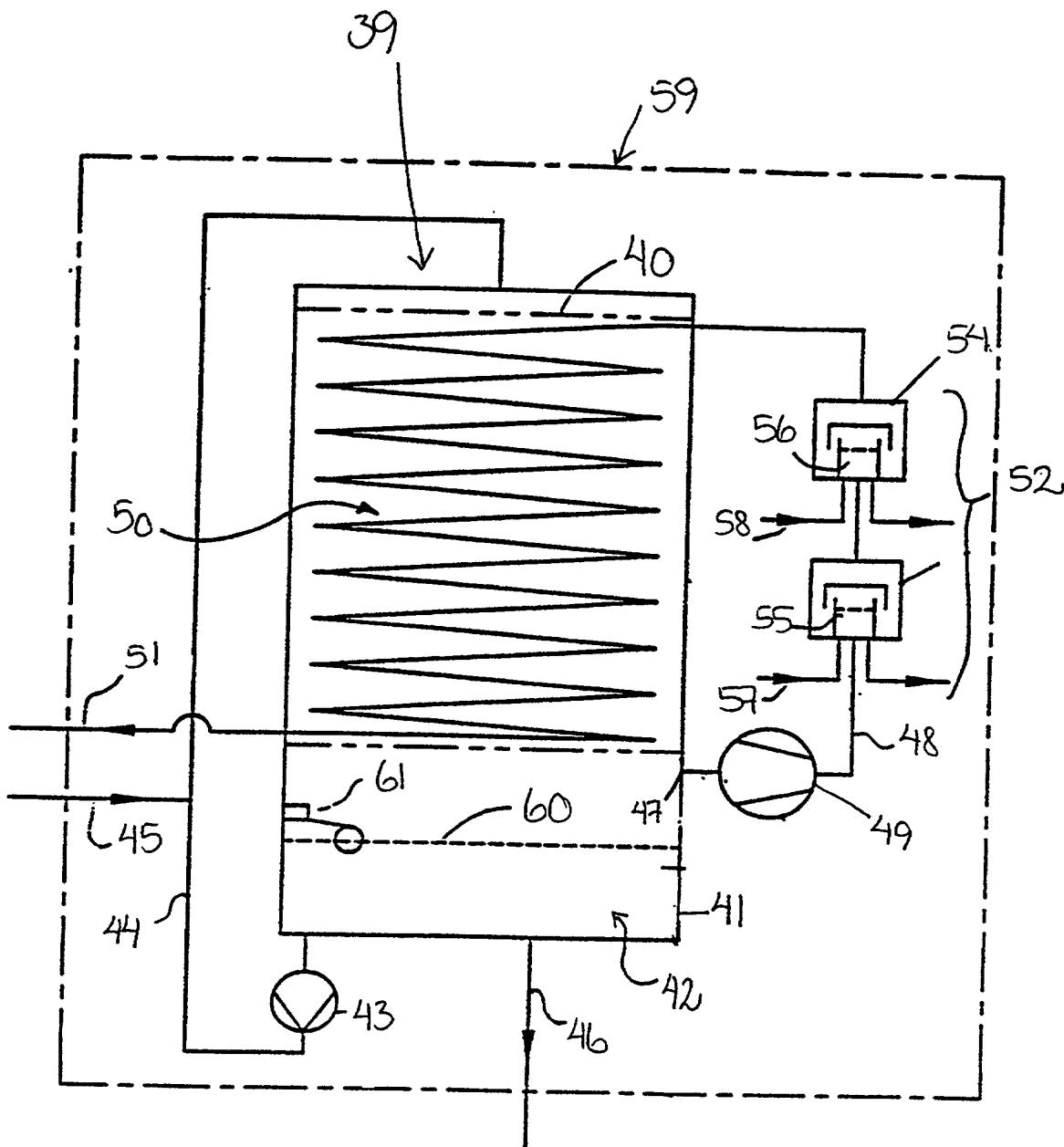
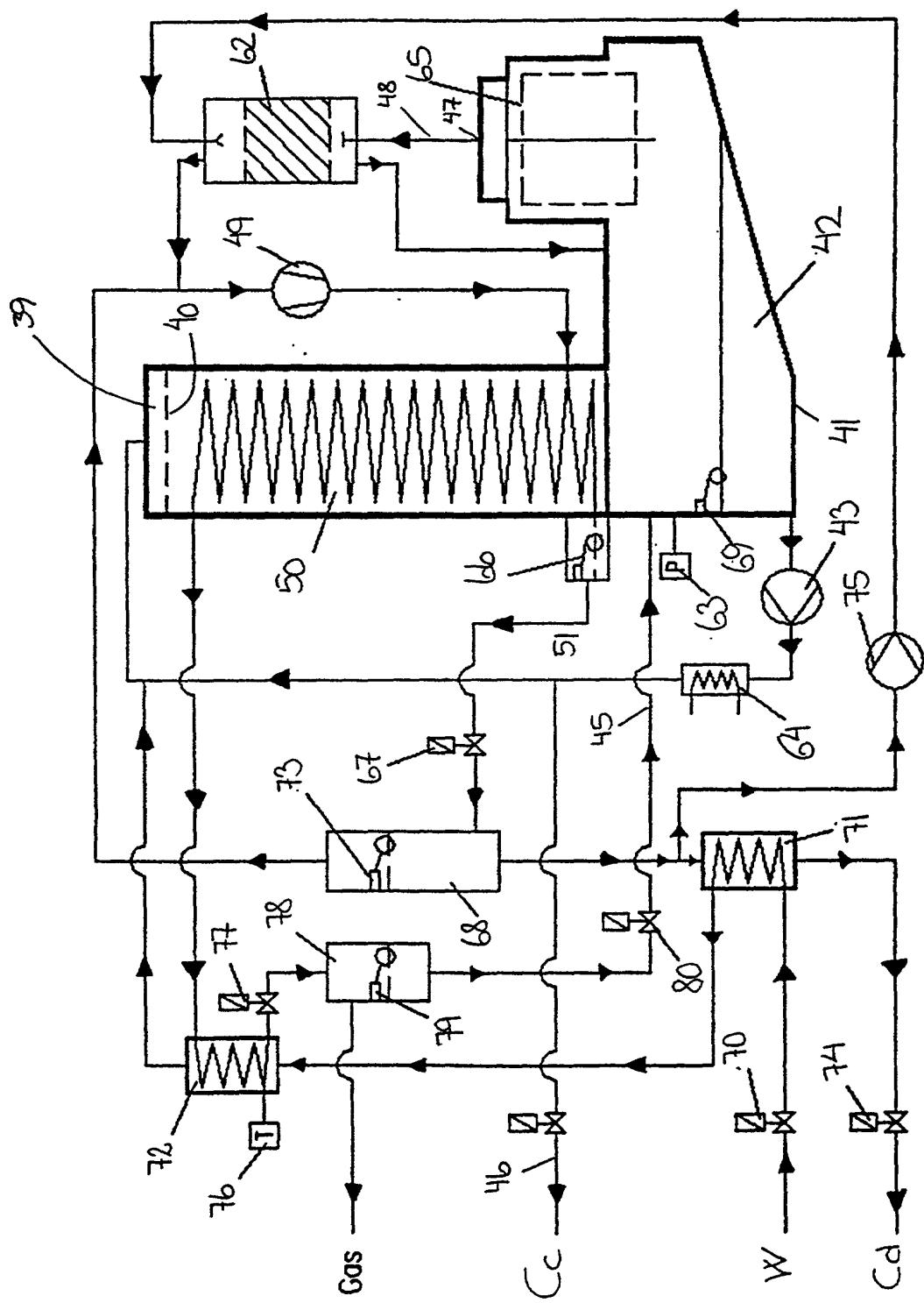


Fig. 2

Fig. 3



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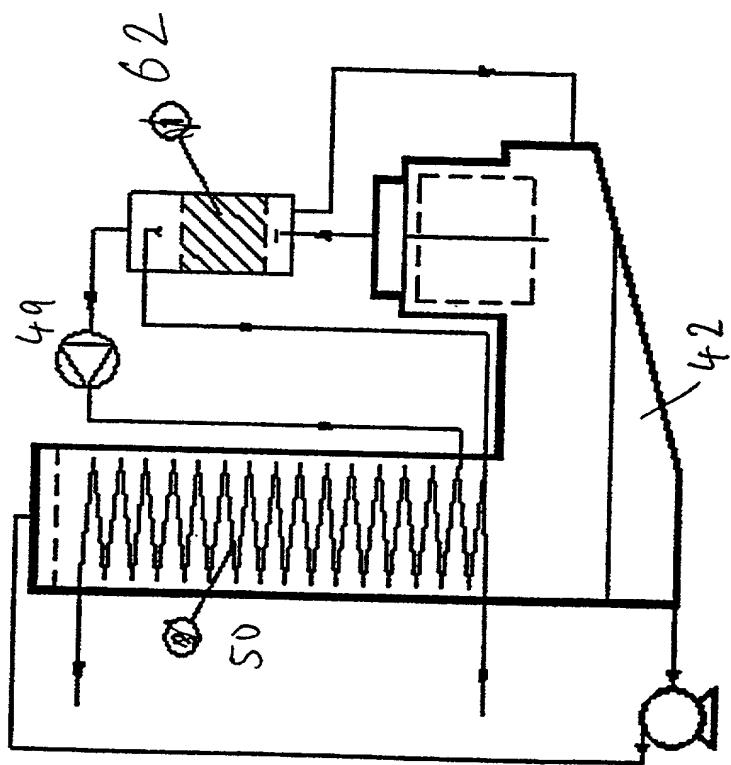


Fig. 4

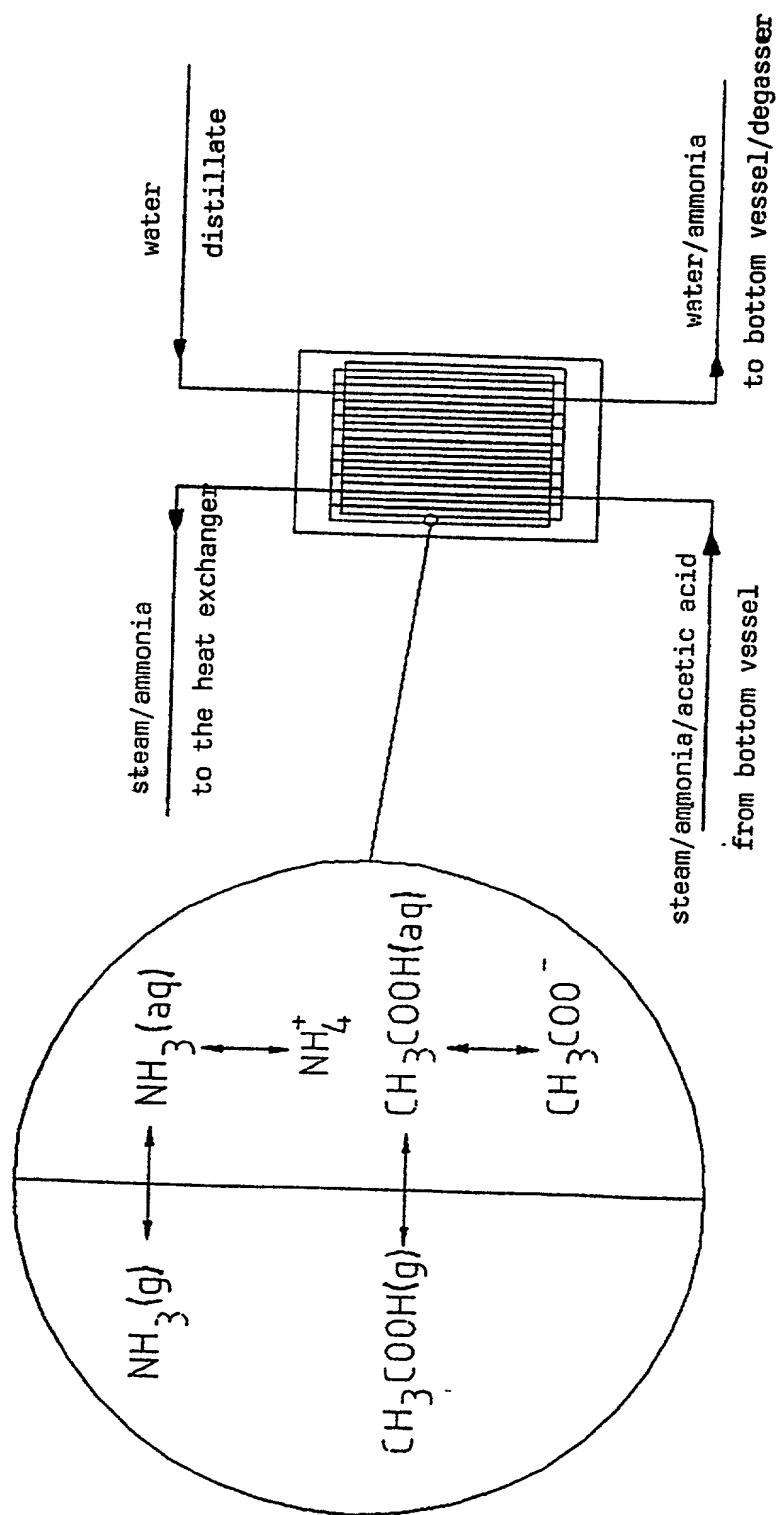


Fig. 5

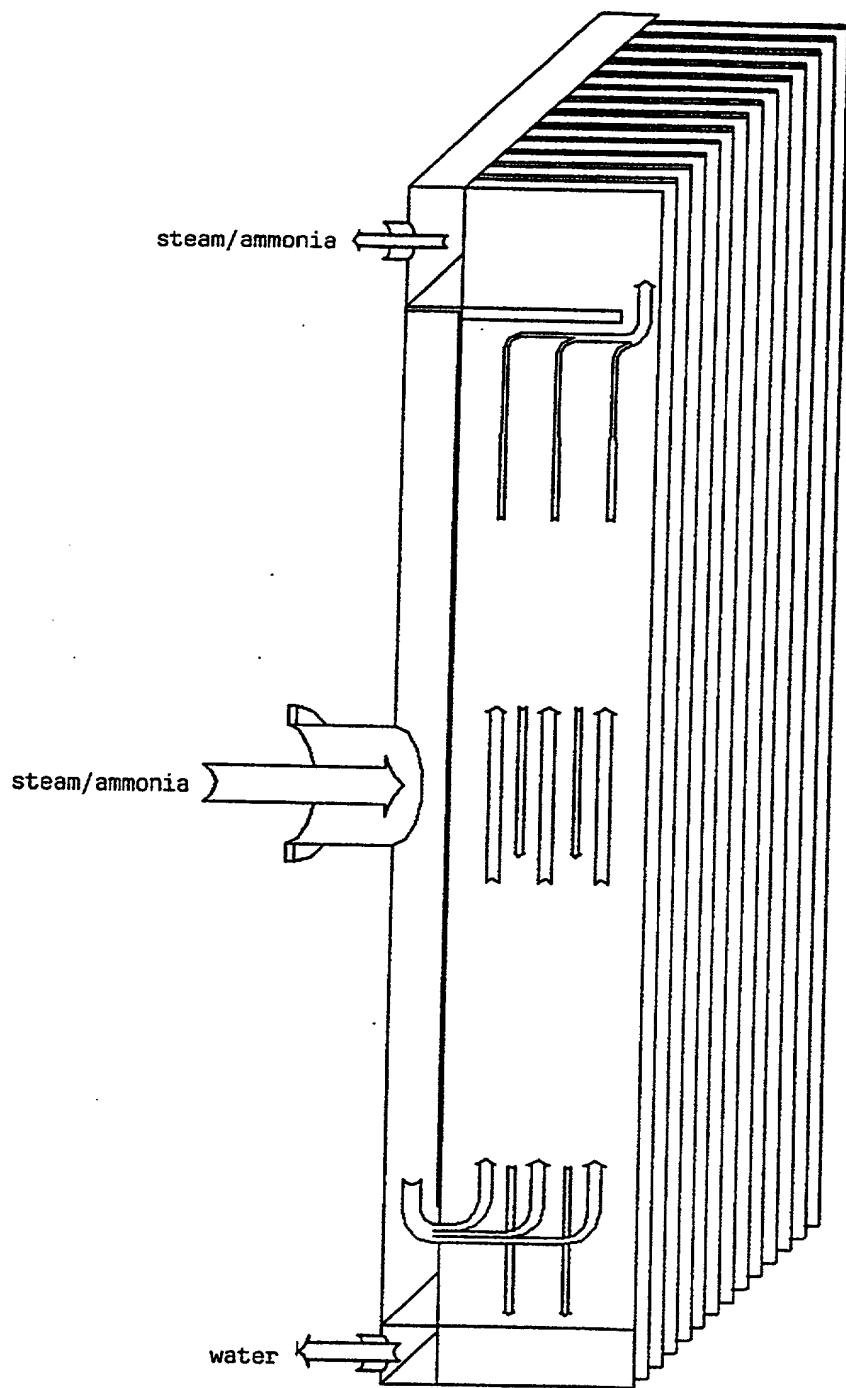


Fig. 6

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**DECLARATION FOR UTILITY OR  
DESIGN  
PATENT APPLICATION  
(37 CFR 1.63)**

Declaration Submitted with Initial Filing

OR

Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

<b>Attorney Docket Number</b>		PATRADE
<b>First Named Inventor</b>		OLSEN
<b>COMPLETE IF KNOWN</b>		
Application Number	09 / 889,361	
Filing Date	07/16/2001	
Group Art Unit		
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Process and Apparatus for Cleaning of Waste Water

*(Title of the Invention)*

the specification of which

is attached hereto

OR

was filed on (MM/DD/YYYY)

as United States Application Number or PCT International

(if applicable).

Application Number  and was amended on (MM/DD/YYYY)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?
			YES	NO
PA 1999 00038 PCT/DK00/00013	Denmark PCT	01/15/1999 01/14/2000	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>

Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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Filing Date	07/16/2001
First Named Inventor	OLSEN
Group Art Unit	
Examiner Name	
Attorney Docket Number	PATRADE

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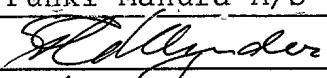
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Applicant/Inventor.  
 Assignee of record of the entire interest. See 37 CFR 3.71.  
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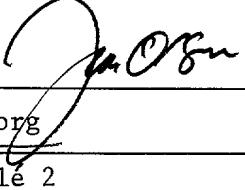
### SIGNATURE of Applicant or Assignee of Record

Name	Funki Manura A/S	
Signature		
Date	10/16-2001	

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below\*.

\*Total of \_\_\_\_\_ forms are submitted.

**DECLARATION — Utility or Design Patent Application**

Direct all correspondence to:		<input type="checkbox"/> Customer Number or Bar Code Label	<input type="text"/>	OR <input checked="" type="checkbox"/> Correspondence address below
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.				
NAME OF SOLE OR FIRST INVENTOR :		<input type="checkbox"/> A petition has been filed for this unsigned inventor		
Given Name (first and middle [if any])		Family Name or Surname		
Inventor's Signature				Date
Residence: City	Sønderborg	State	Denmark	Citizenship
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NAME OF SECOND INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor		
Given Name (first and middle [if any])		Family Name or Surname		
Inventor's Signature				Date
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Mailing Address				
Mailing Address				
City	State	ZIP	Country	
<input type="checkbox"/> Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.				